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Summary Record of the GFF Community of Interest on the Practice and Organization of Intelligence Ottawa Roundtable

What Can the Cognitive and Behavioural Sciences Contribute to Intelligence Analysis? Towards a Collaborative Agenda for the Future

Anthony Campbell
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Defence R&D Canada
Contract Report
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Abstract

This document summarizes two days of discussion between a number of cognitive and behavioural scientists and professional intelligence analysts from 12 countries and a multilateral organization, which was co-hosted in Ottawa by DRDC, Canada's Privy Council Office, and the US Department of State, February 23-24, 2009. This experimental roundtable explored the question of whether and how behavioural and cognitive sciences can contribute to improved intelligence analysis. It concluded that there are many relevant crossovers between these fields, and the time and cost of further collaboration and "bridging" between the scientist-intelligence practitioner perspectives would be fully justified in terms of strengthened intelligence performance and worthwhile scientific discovery.

Résumé

Le présent document résume deux jours de discussion entre des spécialistes des sciences cognitives/comportementales et des professionnels de l'analyse du renseignement de 12 pays et d'une organisation multinationale qui ont participé, à Ottawa, à une table ronde organisée conjointement par RDDC, le Bureau du Conseil privé du Canada, et le département d'État des États-Unis, les 23 et 24 février 2009. Les participants à cette table ronde expérimentale ont examiné si les sciences cognitives/comportementales peuvent contribuer à l'analyse du renseignement, et de quelle façon. Ils ont conclu qu'il y a de nombreuses interconnections entre ces domaines, et que le temps et les dépenses consacrées à une collaboration plus poussée entre les scientifiques et les professionnels du renseignement seraient pleinement justifiées, car ils pourraient améliorer le rendement des services de renseignement et mener à de précieuses découvertes scientifiques.

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Executive summary

Summary Record of the GFF Community of Interest on the Practice and Organization of Intelligence Ottawa Roundtable: What Can the Cognitive and Behavioural Sciences Contribute to Intelligence Analysis?: Towards a Collaborative Agenda for the Future

Anthony Campbell; David R. Mandel; DRDC Toronto CR 2010-012; Defence R&D Canada – Toronto; January 2010.

Introduction or background: This report summarizes discussions in Ottawa on February 23-24, 2009 between several eminent behavioral and cognitive scientists and intelligence analysts and their managers from 12 countries and a multilateral organization. The 55 participants met in an experimental roundtable format under the auspices of the Community of Interest on the Practice and Organization of Intelligence (COI POI) which is a subgroup of the Global Futures Forum (GFF). Its purpose is to promote transnational and interdisciplinary collaboration at the unclassified level to improve security through strengthened intelligence analysis. The meeting explored whether and how the behavioral and cognitive sciences can contribute to improved intelligence analysis. The roundtable was co-hosted by DRDC, Canada's Privy Council Office, and the Bureau of Intelligence Research of the US Department of State.

Methods: The roundtable involved the unprecedented bringing together of an international group of scientists and intelligence practitioners from 12 countries and one multilateral organization to encourage interdisciplinary exchanges and networks. Effective exchanges and network building were promoted through two days of formal and informal discussion in small groups as well as in full plenary. The roundtable format involved a series of prepared presentations by the scientific participants and corresponding commentaries by intelligence practitioners in which the consequences of the scientific insights presented were debated. In the corridors of the meeting special efforts were also made to build professional contacts within as well as between the scientific and intelligence groups.

Findings: The roundtable arrived at consensus on the practical value of the behavioural and cognitive sciences to intelligence analysis. Despite skepticism from some over-pressed analysts with unavoidably short-term daily time frames, the meeting concluded that the analytic community needs to invest time in longer term applied research, and applied scientists in the behavioural and cognitive fields need analyst interlocutors to ensure the practical grounding of their research in relevant fields. This reciprocity of interests was seen as the basis for recommending to governments the desirability of

further collaborative efforts between the two groups following up on the Ottawa roundtable.

Significance: This was an unprecedented multinational meeting between behavioural and cognitive scientists and intelligence analytical organizations spanning three continents. Despite initial skepticism on the part of some analysts, the roundtable demonstrated substantial common ground between the two groups, promoted improved mutual understanding of respective interests and needs between them, and paved the way to more robust collaboration in future than would otherwise have been possible.

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Summary Record of the GFF Community of Interest on the Practice and Organization of Intelligence Ottawa Roundtable: What Can the Cognitive and Behavioural Sciences Contribute to Intelligence Analysis?: Towards a Collaborative Agenda for the Future

Anthony Campbell; David R. Mandel; DRDC Toronto CR 2010-012; R & D pour la défense Canada – Toronto; Janvier 2010.

Introduction ou contexte: Le présent rapport résume deux jours de discussion entre des spécialistes des sciences cognitives/comportementales et des professionnels de l'analyse du renseignement de 12 pays et d'une organisation multinationale. Les 55 participants se sont réunis dans le cadre d'une table ronde expérimentale sous les auspices de la Communauté d'intérêts sur la pratique et l'organisation du renseignement (COI POI), qui est un sous-groupe du Global Futures Forum (GFF). L'objectif de cette communauté est de promouvoir la collaboration transnationale et interdisciplinaire au niveau non classifié, afin d'améliorer la sécurité grâce à une meilleure analyse du renseignement. Les participants à la table ronde ont examiné si les sciences cognitives/comportementales peuvent contribuer à l'analyse du renseignement, et de quelle façon. Cette table ronde était organisée conjointement par RDDC, le Bureau du Conseil privé du Canada, et le Bureau of Intelligence Research du département d'État des États-Unis.

Méthodes: Cette table ronde a réuni – fait sans précédent – des scientifiques et des professionnels du renseignement de 12 pays et d'une organisation multinationale, pour encourager les échanges interdisciplinaires et la formation de réseaux. Pendant deux jours, les participants ont discuté de façon formelle et informelle en petits groupes, et il y a eu également des séances plénières. Les scientifiques ont présenté une série d'exposés préparés à l'avance, et les professionnels du renseignement ont formulé des commentaires sur les conséquences de leurs propositions, ce qui a suscité des débats. Dans les coulisses, des efforts spéciaux ont été déployés pour établir des liens *entre* les scientifiques et les professionnels du renseignement, et *à l'intérieur* des deux groupes.

Résultats: Les participants à la table ronde sont arrivés à un consensus sur l'utilité des sciences cognitives/comportementales pour l'analyse du renseignement. Malgré le scepticisme exprimé par certains analystes confrontés à des échéances à court terme, les participants ont conclu que l'analyse doit investir du temps dans la recherche appliquée à long terme, et que les spécialistes des sciences cognitives/comportementales ont besoin d'interlocuteurs parmi les analystes pour enraciner dans la pratique leurs travaux de recherche. C'est sur cette réciprocité d'intérêts que les participants se sont fondés pour

dire aux gouvernements que de nouveaux efforts de collaboration sont souhaitables entre les deux groupes, afin de donner suite à la table ronde d'Ottawa.

Importance: Ottawa a été le théâtre d'une rencontre internationale sans précédent entre des spécialistes des sciences cognitives/comportementales et des professionnels de l'analyse du renseignement provenant de trois continents. Malgré le scepticisme initial de certains analystes, la table ronde a dégagé un terrain d'entente substantiel entre les deux groupes, elle a favorisé une plus grande compréhension mutuelle de leurs intérêts et de leurs besoins respectifs, et elle a ouvert la voie à une collaboration accrue dans les années à venir.

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1 Overview

This report summarizes discussions in Ottawa on February 23-24, 2009, between several eminent behavioural and cognitive scientists and intelligence analysts, educators, and managers from 12 countries and a multilateral organization. The 55 participants met in an experimental roundtable format under the auspices of the Community of Interest on the Practice and Organization of Intelligence (COI POI) which is a subgroup of the Global Futures Forum (GFF). Its purpose is to promote transnational and interdisciplinary collaboration at the unclassified level to improve security through strengthened intelligence analysis. The meeting explored whether and how the behavioural and cognitive sciences can contribute to improved intelligence analysis. The roundtable was co-hosted by Defence Research and Development Canada (DRDC), the International Assessment Staff (IAS) of Canada's Privy Council Office, and the Bureau of Intelligence Research (INR) of the US Department of State.

The Ottawa Roundtable, as it was called, involved the unprecedented bringing together of an international group of scientists and intelligence practitioners from 12 countries and one multilateral organization to encourage interdisciplinary exchanges and networks. Effective exchanges and network building were promoted through two days of formal and informal discussion in small groups as well as in full plenary. The roundtable format involved a series of prepared presentations by the scientific participants and corresponding commentaries by intelligence practitioners in which the consequences of the scientific insights presented were debated. In the corridors of the meeting special efforts were also made to build professional contacts within as well as between the scientific and intelligence groups.

The Ottawa Roundtable arrived at consensus on the practical value of the behavioural and cognitive sciences to intelligence analysis. Despite skepticism from some over-pressed analysts with unavoidably short-term daily time frames, the meeting concluded that the analytic community needs to invest time in longer term applied research, and applied scientists in the behavioural and cognitive fields need analyst interlocutors to ensure the practical grounding of their research in relevant fields. This reciprocity of interests was seen as the basis for recommending to governments the desirability of further collaborative efforts between the two groups following up on the Ottawa roundtable.

This was an unprecedented multinational meeting between behavioural and cognitive scientists and members from intelligence analytical organizations spanning three continents. The roundtable demonstrated substantial common ground between the two groups, promoted improved mutual understanding of respective interests and needs between them, and paved the way to more robust collaboration in future than would otherwise have been possible.

The chapters that follow provide a record of discussion of the Ottawa Roundtable and follow the layout of the meeting's agenda. Where the subsections of the present report

describe a particular talk by one or more presenters, the relevant subheading corresponds to the title of the presentation that appeared in the agenda.

2 Welcome from the Co-Hosts and Introductions

The Ottawa Roundtable commenced at 09:00.

Tony Campbell, Coordinator of the COI POI and moderator of the Ottawa Roundtable, called the meeting to order and welcomed the participants, who were subsequently welcomed by representatives of the three co-hosts.

Vincent Rigby, Executive Director of the IAS, noted with pleasure the presence of 55 participants from 12 countries and one multilateral organization. He underlined the importance that Canada attaches to unclassified collaboration in the GFF including the COI POI. He described the two key organizing principles reflected in the Ottawa Roundtable – i.e., communities of interest and financial partnership – as significant achievements that deserve to be further developed.

Warren Fishbein, GFF Director at INR, thanked the co-hosts and congratulated the organizers of the meeting for going beyond a single issue and developing a bold "horizontal" agenda on a complex issue that needs to be approached holistically. Innovation in form and topics is what GFF is all about. He took the opportunity to report that the INR had taken on the lead role in Washington with regard to the GFF and was working with the international Steering Group to plan for the future.

Robert Walker, Assistant Deputy Minister (Science and Technology) in Canada's Department of Defence and CEO of DRDC, welcomed this meeting bringing together the analytical and scientific communities. It reflected both the new convergence of defence and national security in scientific research, and the new attention to the human dimension after so many years in which defence science was preoccupied by machines and weapons. Issues such as leadership, shared trust, behavioural effects, understanding ourselves as well as our adversaries, are some of many examples of areas of new interest for DRDC. These issues are of a complexity that requires collaboration and dialogue.

Tony Campbell then reviewed the objectives and agenda, noting the ongoing objectives of trust-building, habits of cooperation, and the generation of practical new knowledge through interaction and dialogue. He singled out Dr. David Mandel, his fellow organizer of the meeting, for special recognition for his hard work and leadership in bringing the Roundtable about. He reminded participants of the "Chatham House Rules" in which only speakers could be directly quoted and attributed.

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3 Scientists Talking to Analysts

The first part of Day 1 was largely devoted to scientific presentations. These were in turn clustered into the following three themes:

a) The role of science in support of analytic integrity
b) Representing and communicating information
c) Psychological perspectives on emotion, risk, and inferring intent.

3.1 The Role of Science in Support of Analytic Integrity

3.1.1 Setting the Stage: The Role of Science in Applied Communities

David Mandel opened his presentation by noting that the origin of DRDC support for the COI POI was a 2007 meeting organized by the US Office of the Director of National Intelligence (ODNI) that also brought together behavioural scientists and members of the intelligence community. That meeting had demonstrated the value of bringing the science and technology and analytical communities together to allow practitioners in these areas an opportunity to get a deeper insight and "feel" for the other's perspective. However, Mandel noted that there was insufficient opportunity for the scientists and practitioners to talk to one another in order to better coordinate their understanding and interests. For that reason, DRDC and COI POI decided to plan a workshop that would once again bring the two communities together, but which would aim to do so in a manner that afforded more opportunities for semi-structured discussion and interaction between the scientists and practitioners around the question: "What can the cognitive and behavioural sciences contribute to intelligence analysis?"

He noted that there is a substantial body of literature that indirectly addresses this question including, for example, decades of research on judgment and decision-making. Most of it, however, remains in a form that is of limited use to the intelligence community, not to mention outside its awareness. Of course, that literature, which is mainly geared towards academic theory testing, is not written in a manner that speaks directly to intelligence issues. Thus, bringing eminent scientists that have a track record of concern with applied issues together with practitioners in the intelligence community offers an important opportunity to communicate some key results and ideas to the intelligence community and have them, in turn, respond to those ideas and express their own views about how science might help improve the practice and organization of analysis. By having analysts and other members of the intelligence community directly engaged, scientists may be better able to carve out research directions for the future that would directly address analytic concerns.

Through their expertise in scientific research and statistical methods, cognitive and behavioural scientists are particularly well suited to assess the applicability of possible analytical innovations just as the analytical community is best able to guide and ensure the relevance of science and technology in this area to its practical and organizational needs. The COI POI was seen as an appropriate setting for this dialogue and, for that reason, the sub-theme of the Roundtable is "towards a collaborative agenda for the future."

3.1.2 The Objective Analysis of Analysis

Paul Lehner began his presentation with three main conclusions:

a) Intuition, experience and expertise are an inadequate basis for determining how to improve expert practices in intelligence analysis – accepted best practices are often ineffective, and effective practices are often counterintuitive.
b) Science can help – objective scientific analysis is needed to help distinguish which analytic practices really do work and which ones don't.
c) Effective best practices are often counterintuitive so expect to be surprised – but not deterred since collecting scientific data does not have to be a burden.

He emphasized the importance of objective scientific analysis and warned against practitioners evaluating their own practices. He sought to disprove that greater expertise leads to more reliable results, using the example in which scientific testing showed that in deception (lie) detection, experts were 54% accurate, on average – a value obviously very close to the 50% accuracy rate expected by pure guesswork or random chance. Lehner noted that testing of horse-race handicappers suggests that information saturation seems to increase expert overconfidence, not accuracy. Thus, more information increases our sense of certainty but not necessarily the quality of our judgments and decisions.

Biases have been shown scientifically to substantially impact expert judgment. "Judgment bias" involves drawing conclusions with insufficient data. "Confirmation bias" involves ignoring or under-weighting information that is inconsistent with the expert's current views. Over-confidence involves overestimating the certainty of the expert's judgment (and therefore the integrity and utility of the practices that led to those judgments). "Hindsight bias", as Tetlock found in his landmark study of experts' political judgments, occurs when individuals believe after the fact that they predicted outcomes different than they actually had predicted, with a drift of 10-15% in the direction of what had actually happened.

He outlined four practices that are found to be effective:

a) Systematically average-out independent forecasts. Accurate forecasts can often be achieved by disallowing inter-analyst discussion: the accuracy of consensus forecasts is about the same as random forecasts (namely, guesswork).
b) It should be possible to mitigate over-confidence by having analysts use scientifically tested tools, though Analysis of Competing Hypotheses (ACH), which is often regarded as an effective method for reducing overconfidence, has received little systematic research attention.
c) Simple prediction models work well (start with a set of candidate variables and pare down).
d) Role play and simulations in conflict situations have been proven to work quite well when forecasting.

A key message was that expertise and experience are a poor foundation – poorer than objective scientific research – for determining how to improve analytical practices. But there is substantial room to improve them and "we know how to do it." Nevertheless, most "good pet ideas" do not work and one should expect to be shocked by the results. "Finding the few good ideas that work takes lots of investment." And it also requires overcoming "methodological bias" – "without objective testing, we are far too easily convinced that our methods work."

3.2 Representing and Communicating Information

3.2.1 Integrating Formal and Narrative Analysis

Baruch Fischhoff outlined the analyst's key challenges: to develop information relevant to the users' needs, to communicate clearly and concisely, to capture assumptions, and to ensure a robust outcome. However, in addition there is a cognitive challenge in which the analyst has to integrate two different ways of knowing: formal versus narrative. This requires an integrative approach adapted to intelligence applications. And it involves implementation challenges because the problems are complex, non-linear, etc.

Behavioural research shows that "people are simple" but predicting decision making is difficult because behavioural research shows that the set of relevant cognitive principles is large, the contextual triggers are subtle, and the interactions are complex. He zeroed in on six relevant cognitive principles:

a) People rely on imperfect heuristics and therefore we need to see cognition in the context of task demands and avoid sweeping generalizations.
b) Self-reflection is difficult, both concurrently and in hindsight, and therefore we need the ability to calibrate performance empirically.
c) People can't change their ways of thinking quickly without losing cognitive control, therefore we need measured transitions.

d) Overconfidence arises from unwitting omissions, perhaps novel, perhaps conventional, and therefore we need transparent, theoretically neutral platforms.
e) People need integrative cognitive structures for complex inferences and therefore we need to structure analysis.
f) People overestimate how well they read others' minds (when extracting and communicating information); therefore we need two-way communication between analysts and clients.

He went on to discuss "a continuum of analytical approaches" in which he focused on the efficacy of scenarios and the importance of integrating models and scenarios. Scenarios can stretch minds, bound certainty and complexity, help to develop strategies and demonstrate leadership. However, they are not generated systematically or updated, are not clearly linked to action, are not easily evaluated, and are not transparent. Similarly, formal models are claimed to accommodate diverse forms of knowledge and aggregate information transparently. However, they can omit knowledge that is not readily quantified or represented on the team. They can be too complex for effective review, have exaggerated precision, and leave users without a clear shared picture.

Therefore, it is necessary to integrate models and scenarios in order to provide a sufficiently flexible conceptual structure to users. This balances formal and narrative insight, values completeness and conceptual precision, and allows analysts to maintain cognitive control while providing a platform for deliberation that allows us to balance formal and narrative insights and remain neutral on content and conclusions. He presented a "mental models" approach, which uses influence diagrams, as one viable solution for integrating insights from scenario-based assessments with more formal approaches. Mental models can be specified with a great deal of precision (e.g., by quantifying the strength of relationships between elements of a model) or left imprecise as an overall representation of subject matter expertise.

3.2.2 Communicating about Risk and Causality

Denis Hilton addressed how to optimize communications once the analysis is done to facilitate decision-making. He noted that while training in thinking skills has had limited success in improving decision-making, simple changes in the way information is communicated can provide substantial improvements in decision-making. In particular, we can improve communications about probability and causality through attention to:

a) conversational norms that govern human communication and guide attention to what is relevant, and
b) representational formats that improve the ability of analysts to piece together information in ways that ought to improve the integrity (e.g., accuracy and coherence) of analysis.

The aim of his talk was to encourage the design of efficient communications that follow principles of relevance, avoid redundancy, and are aware of framing effects and order effects. In addition, he aimed to offer a guide for the choice of good "external representations" with the goal of capitalizing on people's "visio-spatial abilities" whenever possible.

To begin with, he outlined some general rules of communication in organizations, distinguishing between verbal and written communication. He underlined the importance of recognizing the two perspectives in communication design: the speaker's and the hearer's or the encoder's and decoder's. He noted that, in experiments designed to test hypotheses about thinking, the scientists had noted certain "communicational effects" on judgments and decisions. One implication of this is that *how a report is written* will lead people to or away from interpretational errors.

His second broad theme addressed the decisions that need to be taken in communication – decisions that bear on what, when and how to transmit messages. In preparing a report, there are three key decisions: what information to include or exclude, the order of presentation of the information, and the framing of that information.

In selecting or omitting information, there is a dilution effect. If an item is included, the receiver expects that it will be relevant. However, in an information "tsunami", the vital information can be lost or "diluted" by other less vital information. The implication, then, is that more information is not necessarily better for judgment and decision-making. Moreover, conversational norms play a role in this effect people feel they should use all the information presented; namely, that if it was communicated, then it must have had relevance.

The ordering of information is another key decision in communication because studies show that it has a robust effect on impression formation and other judgments. With "primacy effects" information inserted earlier tends to receive most attention in judgment, whereas with "recency effects" later information received is given more weight. Other factors, such as the delay between information acquisition and judgment, in turn, moderate whether primacy or recency effects would be more likely to occur in a given analytical situation. Hilton noted, as well, that the evaluative tone of the message can also subtly influence the way messages are interpreted. Order effects on judgment are real, and tend to easily escape notice.

Dr. Hilton then turned to decisions to be taken about graphical representations. A substantial part of the brain, he proposed, is dedicated to visio-spatial processing making it desirable to use graphical representations to tap that processing ability. However, decisions about representation must be made carefully since poorly represented graphical information has been shown to be able to cloud judgment, whereas good graphical design can improve judgment. His advice was to structure graphical information in ways that conform to regular conversational rules or norms, including a "scaffold" structure that

combines conversational norms with what we know about the strengths and limitations of human information processing.

He concluded with some recommendations. First, keep it simple and smart. Beware of order effects and framing effects and test your planned approach against alternative order and framing approaches. Pay attention to the "conversational" aspects of graphical representations – i.e., be relevant, succinct, and use symbols that the reader knows. Finally, be aware of human information processing propensities: when processing verbal information, narrative "stories" may take hold easily. This may be good for motivating a decision, but it can also distort perceptions if the narrative "goes beyond" the communicated facts. Secondly, elicit visio-spatial processing through graphical presentations when you can. To draw on Pascal, the reader's eye sees things that the mind comprehends not.

3.3 Psychological Perspectives on Emotion, Risk, and Inferring Intent

3.3.1 Risk as Analysis and Risk as Feelings: Some Thoughts about Affect, Reason, Risk, and Rationality

Paul Slovic addressed issues of risk perception relevant to analysis with emphasis on affect, reason, risk and rationality. He noted that the language of risk is problematic because there is no such thing as an objective risk. Rather, humans invented the concept to help them cope with dangers. The term has multiple meanings ranging from "hazard", to probability, to consequence (severity). It is a "judgment-laden" term often reflecting underlying values in which one also has to allow for perception, which has a reality of its own.

Risk is multidimensional and an exercise of power. Whoever defines risk defines priorities. Acceptance of risk tends to be reduced if (1) the hazard is new, (2) exposure is involuntary, and (3) it involves human failure as opposed to being natural. Risk perceptions and cognitions interact with social and institutional forces that can trigger massive social impacts, including "stigma effects". Accidents can be seen as signals that provide valuable new information about the likelihood of similar or more destructive mishaps. Signals can have "allegorical import" in terms of what the event portends. This can lead to a social amplification of risk (ripple effects) where the signals determine how individuals and media perceive the seriousness of the risk. It follows that risk perception research is useful for analysts of risk in that it offers insights that are predictive of public perceptions of risk.

Humans typically rely on their gut feelings to perceive and respond to risk – "the common currency" of affect influences risk perception. It mainly arises out of our socialization. It is also shaped by "neuro-economics" because the brain is an "economic

risk assessment machine". Damasio's research showed that even when we are reasoning, we are feeling. Thus we think in two ways: intuitively (affective) and analytically. We need both systems to behave optimally.

In this affective way of reasoning, images are especially important drivers of affect (feelings). These in turn drive behaviour including decisions. But he warned analysts to remember that images are not just pictures - words can also create affective images with powerful effect on the feelings and decisions of the decision-maker.

3.3.2 Thematic Analysis of Leaders' Statements as Indicators of Intent

Peter Suedfeld addressed thematic content analysis and integrative complexity in asking the question – how can psychology help analysis to enter "the thought process of an enemy commander and predict what course of action he intends to pursue."

Thematic content analysis of archival sources is an important approach. It involves scoring the level of specific thematic variables, quantitative statistics using reliable (tested) tools, and replicable and rigorous methods. It is *not* merely counting word or phrase frequencies. It has advantages (e.g., it is non-intrusive, flexible) and disadvantages (e.g., it has uncertain internal validity, access to important source materials may be restricted or unavailable).

Integrative complexity is a thematic content-analytic technique for analyzing the structure, not content, of statements. It can be scored. It evaluates the level at which information is being processed in a given situation. It involves differentiation (the perception of more that one dimension of a stimulus or more than one legitimate attitude about it) and integration (the combination of differentiated percepts in mutual interaction, synthesis, trade-off, or "as units within a super-ordinate schema"). It is useful in analyzing individual information processing and decision-making questions.

Where there is high integrative complexity there is a high-level information search, consideration of others' viewpoints, flexible planning and strategizing, tolerance for uncertainty and ambiguity, and acceptance of nuanced trade-offs. The implications of low integrative complexity include a limited information search, rigid following of established plans, black-white (good-bad) evaluation, or rapid decisions favouring simple, all-or-nothing strategies and solutions. Integrative complexity changes under stress, and these variations in integrative complexity predict success or failure of a leader's actions in a variety of situations. People maintaining or increasing integrative complexity may be able to sustain multiple roles, parallel processing and a high information load, but they may be slow and uncertain in making decisions. Significant reductions in integrative complexity under stress indicate rigid, uni-dimensional, self-focused thinking and a failure to process information. However, low integrative complexity allows for rapid, decisive decisions.

Integrative complexity can predict crisis outcomes including situations where conflicts spiral – i.e., escalate or de-escalate – or it can reveal aggressive intentions with regard to possible surprise strategic attacks – or it can help predict whether "simmering pots" will boil over. Thus, integrative complexity analysis can be used to identify behavioral patterns in crises that are reliable across nations and historical periods.

4 Analysts Talking to Scientists: Applications and Implications for Intelligence Analysis

The second major part of the first day of the Ottawa Roundtable was devoted to reflections by members of the intelligence community regarding the presentations they had just heard. First, a four-person panel of practitioners was asked to reflect on the applications and implications for intelligence analysis of what they had heard from the initial speakers. Following the panel discussion, small working groups, each comprised of scientists and practitioners, were formed with the aim of having the members explore a range of questions dealing with the behavioural science of intelligence analysis. Each of the groups reported back during a subsequent plenary session, which culminated in a general discussion.

4.1 Analytical Perspectives Panel

Arne Biering of Denmark found the scientists' presentations interesting and most helpful. Applying their insights to actual analytical practices can be difficult, as he had learned in dealing with the challenges of teaching proper analytical techniques. Nonetheless, he was inspired to link ideas that had been presented to his service's training approaches. Hilton's views on communication were of particular relevance to policies in his service and his views tended to usefully confirm them. He was also interested in Suedfeld's findings (on leaders' statements as indicators of intent) and he wondered how they might be compared to classified intelligence warnings. However, he noted the risk that leaders could possibly use those findings to deceive analysis.

Carmen Medina of the US noted that all the issues raised were at the centre of analytical interest. They touched not only on the process but also on the substance of analysis, since we are not so much analysts of countries as much as analysts of behaviours. The presentations underlined the importance of open source material and the concomitant use of deep data techniques. She encouraged managers to expose their colleagues to the ideas presented by the scientists. In that regard she commended a website (www.tedtalks.com) for a talk on cognition and the different parts of the human brain which she had found helpful (see www.youtube.com/watch?v=UyyjU8fzEYU).

Glenn Robinson of Canada commented that intelligence managers and analysts are concerned about how scientific insights can be applied to their work where the urgent so often has to trump the desirable. Analysts constantly have too much data and too little time. It is a challenge for managers to deal with this situation and foster improved results. This raises the question of whether techniques are more important than knowledge. With those practical caveats, he went on to identify the "take away" points he had found most valuable: the importance of challenging biases, the difficulty of overcoming standard approaches, the importance of effective presentation, the idea of combining narrative and

modeling to validate analysis and to give these to a client to demonstrate that an assessment has a system behind it and is not just impressionistic, and finally, the importance of language in the shaping of a report. He had come to the Roundtable as a skeptic and was leaving realizing that analysts will benefit from openness to what science can offer. The challenge is how to bring the scientists into collaboration when their contribution will be seen as having a "long term payback" in a short term context. Even so, he could see some practical challenges he faces as a manager that a scientific perspective could help him resolve such as how to most effectively cover a large area with few analysts. How could one organize such a contribution without losing much time?

Elaine Ruffell of the UK found that the presentations demonstrated "the more you know, the less you actually know". By reference to the Myers-Briggs personality profiling method with which she was familiar, she described the analytical community as introverted and with a clear preference for dealing with the tangible, no trust of the "6th Sense", task-focused and disliking of ambiguity. Clients tend to be Introverted and Judging which makes matters worse. For that reason she thought there should be more extroverted and intuitive types hired for analysis with openness to Feeling and Perceiving. They are people-driven, love ambiguity and are the nightmare of analysts. These observations indicate the difficulty she will face in speaking at home about the ideas that had been put forward – it will be seen as a different universe. How does one bridge the gap?

4.2 Plenary Reports from Small Groups and General Discussion

Several important issues or themes emerged from the small group discussions. One, directly linked to the overarching topic of the Roundtable, was that more effort and time needs to be dedicated to convey to intelligence analysts the relevance of scientific research and theorizing to analytical work. There was broad consensus on the importance of achieving that goal. Most analysts seemed to believe they are going about their work "scientifically," yet there was recognition after the day's presentations that actual analytical activity has little basis in science and scientists would not consider analysts as really using scientific methods. Accordingly, there was appreciation of the value of "outside-in" thinking such as listening to behavioural scientists and familiarizing themselves with their "open-source" findings. At the same time, however, some groups noted that translating the insights of scientists into practical applications for analysts remains a central challenge. Recognition of the need to focus more on understanding the client better from a behavioural science point of view was seen as a significant benefit of the day's discussion.

There were a number of areas where the groups saw opportunities for building bridges between science and practice. For instance, many agreed that the value of various forms

of content analysis should be further studied and tested. As well, it was acknowledged that dealing with probability is important. Some groups discussed whether analysts' confidence levels should be described in terms of numeric odds or percentages, and which approach better represents good science. The conclusion was that researchers could help to determine which was most effective for which kind of problem. The presentations concerning the use of language were recognized as being of fundamental importance to analysts. Vague predictive words should be shunned (e.g., "maybe", "could"), and behavioural science research could shed light on the vagueness and ambiguity of different terms.

In a related vein, there was debate about the degree to which behaviour can be predicted accurately. There was some debate about the importance of achieving predictive accuracy. Some participants advocated for the importance of striving for and measuring predictive accuracy. Others, mainly in the analytic community, saw their "value added" in the assessment and understanding of situations with less concern for numerical prediction. Sometimes, providing the conceptual framework and identifying key drivers is just as valuable to clients as "the forecast."

The importance of developing visualization techniques was also highlighted. There was concurrence that greater prominence to models and pictures is desirable but it was also acknowledged that there are individual differences in preferences for words versus pictures. Some groups suggested that clients prefer having some graphics over purely narrative reports and that, for that reason alone, visualization in analysis is bound to increase. If there is greater use of visualization, there is a challenge to capturing complexity in graphics. There can be distortion through simplification. And nuances can be lost and biases subtly introduced. Again this was seen as an area where behavioural science could help shed light.

Some noted that there was little mention in the discussion concerning matching analytical tools to analytical techniques. There was also skepticism voiced by some in the analytic community of the contention that collective approaches have limited and possibly counterproductive value.

There was discussion of how the issues raised at the Roundtable might bear on a new generation of analysts. For example, how does a 22 year old analyst have credibility with a colonel? One suggestion was to expose the colonel to the milieu and methods of the analytical community. It was accepted that credibility should be an ongoing concern and science can be of help in addressing this.

A follow-up workplan might include (1) ongoing debate in the analytical community about the value of computational prediction on the one hand and conveying situational and descriptive awareness on the other; (2) further work to find ways to translate the ideas and concepts heard from scientists into language analysts can understand, relate to and apply in practice; and (3) the analytical community needs to focus more on

understanding the nature of the client/decision-maker, and here also scientists can be of help.

5 Dinner Lecture: What Can Jazz Contribute to Intelligence Analysis?

Arthur Katona, a retired Canadian senior analytical manager, backed up by Dr Jazz, a musical combo, posed the question: "What can jazz contribute to intelligence analysis?"

He pointed out that his career had been one in which he did analysis by day and played music by night and, despite obvious differences, had found a high level of complementarity between the two activities.

In his later years most of the most important intelligence assessment work was done collectively in "peer groups" from other organizations even though analysts continued to put in a lot of time alone and in their own agencies maintaining their expertise and situational awareness. "When the groups met, the tone and direction of discussions, and the results were often difficult to predict because something intangible would come out of the interaction of such expertise. The collective insights would shift, and most people around the table would see things in a slightly new light and with fresh understanding – when things worked well!"

Jazz musicians like analysts spend a lot of time alone, practicing for hours on end, studying, writing music, listening to recordings, and so on. "When jazz musicians get together in a band, in their own version of a peer group, they generally have common backgrounds, interests and reference points." Yet when they play together and improvise collectively, "musical conversations and listening are always taking place and, in a very real sense, a constant series of negotiations is going on among them – like analysts." Something intangible happens to everybody on the bandstand. The result is often new insights, new energy, and new interpretations, just like analysts – when things work well!"

But of course, things don't always turn out as they should. Musicians are individuals with many levels of skill, understanding, knowledge, and concepts of self-expression. There are many different and opposing schools of jazz, each with its own proponents and ideologies – just like intelligence analysts.

Here are ten lessons based on the similarities between intelligence assessment meetings and jazz sessions.

- Analyst meetings and jazz sessions involve ongoing conversations and spontaneous negotiations among participants so that for success there needs to be agreement on common ground rules and parameters, either implicitly or explicitly.

- Both analysts and musicians have to communicate effectively with an audience, which includes getting feedback from that audience. Both have to be concerned with pleasing the clients while, paradoxically, realizing that they may lead clients in sometimes unexpected, uncomfortable or even unwanted directions. Both need to educate clients on the nature and value of their product. (In both cases, clients can be real or virtual, and services can be live or recorded.)
- Analyst meetings and jazz sessions require a skillful blending of individual creativities with group dynamics – and yes, creativity does play a role in the intelligence process.
- Both demand the discipline to follow mainly unwritten rules and norms, while paradoxically, pushing the envelope and striving to think (or play) "outside the box".
- Both involve lengthy and focused preparations.
- Both need to use tactical judgment in responding quickly to unforeseen situations – to adjust on the fly, to improvise.
- Both have had to make significant strategic adjustments over time – e.g., jazz after the bebop revolution of the 1940's and intelligence analysis following the Cold War and after 9/11.
- For both analysts and musicians, a little humility is helpful. Mistakes are made by individuals and groups. There is a constant need to self-evaluate, to question, to learn, to change and adapt. A balance needs to be found between self-confidence and self-criticism but analysts and jazz musicians need to be able also to maintain self-esteem in the face of outside criticism.
- Both worlds have challenges in developing new generations of participants including education, mentoring, and developing analytical and (musical) skills.
- Finally, both involve a forward-looking optic, while being based on what has gone before. Jazz musicians in their collective improvisations are simultaneously concerned by the present and what is coming next in the song they are playing – just as how intelligence assessments seek to provide an understanding of how and why certain future outcomes are probable.

6 Organizational Perspectives

The second day of the Ottawa Roundtable began with a brief discussion led by Tony Campbell of thoughts and ideas that occurred to participants overnight. The principal thrust of comments was that there are clearly all sorts of "crossovers" between intelligence analysis and behavioural science. Intelligence is fundamentally about human behaviour and the science of human behaviour is obviously of high and possibly crucial relevance. These overnight reflections led into the first main session of Day 2 which examined Organizational Perspectives.

6.1 What Makes a Great Analytic Team?

Richard Hackman discussed his findings in scientifically observing the performance of successful and unsuccessful analytic teams. This research was challenging because the target of his studies – the team and how it functions – is changing, primarily because of new technologies and the accelerating pace of change.

He posed a puzzle: why do analytic teams have more resources, more flexibility, and more potential for synergy but their performance is still often "sub-par"? This has often been attributed to poor leadership, or to a team being used for work that is better done by an individual, or the task is too hard, or the team has been set up in a way that constrains its performance.

He described the "domain of (analytic) teams" as "work being performed by a bounded group of professionals who share responsibility for using data that are incomplete and/or of uncertain reliability to generate conclusions about something that has happened, is happening, or is likely to happen." When forming a team most of us assume the key element is finding the best expertise but research has shown that much more is involved.

The first question to address is "when do we actually need a team for analytic work?" And, if so, "of what kind?" This requires us to recognize that there are four types of teams depending on their degree of "responsibility for outcomes" and their level of "synchronicity," as well as on the distinction between the role of individual members and the team as a whole. There are "co-acting groups" (asynchronous members, low accountability for outcomes), and "surgical teams" (real time interaction), and there are "distributed teams" (asynchronous interaction, high accountability), and face-to-face groups (real time interaction, low accountability).

What are the signs of an effective team? After a study of 64 units in 6 different American agencies, Hackman and a colleague arrived at a set of "highly reliable" criteria for team effectiveness:

- task output is (at least) acceptable to those who receive, review, or use it and that is occasionally “magical”
- members become increasingly competent in working together as a team
- members’ personal growth and well-being are fostered by their team experiences

They found that when combined these three things indicate effectiveness. The problem for researchers was how to measure these variables in real terms. Associated with them are process indicators of good teamwork: ample effort, a task-appropriate performance strategy, and a full use of member knowledge and skill.

The five conditions that strongly predict effectiveness are:

- it is a real team (bounded, stable)
- it has a compelling direction
- it has a sound team structure
- it has a supportive organizational context
- it has expert coaching available

In addressing the questions, “what holds analytic teams back?” and “how can they be released to do their work well?,” Hackman identified the following:

- A key concern is failure to “bound” the team (i.e. fluidity is good but members must know who is part of the team).
- Generally speaking, it is a misconception that teams become less efficient over time.
- Teams must know their purpose. The best is where a team is given well-specified objectives or goals but is allowed by their leader to develop their own means for achieving them. The worst case is a team that has plenty of means and no clear end state envisioned (as signalled by their goals). Teams with both ends and means also can be a problem because they usually waste resources (or fail to see opportunity costs; i.e., how the same resources could be applied toward achieving other objectives).
- Other “tripwires” to avoid stumbling over include having half a task or less, team-unfriendly environments, and inadequate team coaching. A major problem in the intelligence community is a tendency to divide a problem into its components instead of approaching the task as a team project (which would allow organizing to balance one person’s weaknesses and another’s strengths).
- Joint work is almost always more productive if the right conditions are met.
- Education is a good predictor of excellent teams but rewards are not.
- Coaching can play a useful role especially in teams with lots of expertise. “Unguided groups with a lot of expertise tended to do the worst” because the expertise got in the way. So coaching can help, but only if the team has been well designed.

- The best coaching is peer coaching. “Leader coaching usually helped a little, but peer coaching predicted team effectiveness better than any other variable.”
- Research shows that competitive teams can be counterproductive because they generate unhealthy dynamics such as an “us versus them” approach, positioning to win, strong pressures for conformity, and distorted perceptions, judgment, and reasoning. Studies of Team A/Team B and “Devil’s Advocacy” approaches have documented these problems.

A key “take-away” from the presentation is the need for leaders to create or “enable” the necessary conditions for teams to succeed:

- the cognitive abilities of the team should fit with the demands of the analytic task
- the team should aggressively explore strategies for integrating each other’s work
- the leader should coach at the margins
- peer coaching is best

For further information he referred to his book “Leading Teams” and a new book “Senior Leadership Teams”. Or visit the Harvard website: http://www.leadingteams.org. A Team Diagnostic Survey can be found at https://research.wjh.harvard.edu/TDS.

6.2 The Intersection: How We are Organized and How We Think

Josh Kerbel focused on the nexus of cognitive science and intelligence analysis, particularly the interplay of language, thinking, and the metaphors we use. He used to analyze Chinese thinking but over time he became more interested in how we think about the Chinese than about what they think.

The various ways the US Intelligence Community is organized affects how we think about issues: in terms of organizational needs, by domain or discipline, or by intelligence type (imagery, signals, human). Perhaps of even greater influence is the tendency to assign each analyst their own account which results in a narrow account structure and atomization of analysis.

This happens because we are products of our western intellectual tradition. The standard ways of thinking in analysis are based on a reductionist mindset where the mind is like a machine. Analysts are in the business of predictions through trend analysis, disaggregating the world and encouraging specialization. This approach reflects the influence of Aristotle and Newton. Their linear approach combined at the national security level with the formative influences of the Cold War and Clausewitz to produce the mindset of the intelligence community. Specialization goes hand in hand with little experience in or incentive to do multi-disciplinary analysis.

If this is the way we think, is it a good thing? There are some advantages to the linear, reductionist model including its simplification and predictability. But there are downsides too: the world is not a machine, it is organic, it is increasingly complex, and it is interdependent. So our thinking model diverges from the reality of the world we live in. If we do not adapt to a more syncretic way of thinking, we will be increasingly surprised by world events and trends. But at the same time, a non-linear thinking approach has a great deal of uncertainty.

So how should we think? We need to cultivate a different way of thinking that emphasizes a world that is fundamentally organic, dynamic and constantly changing. This in turn requires that analysts are creative: if they rely solely on critical thinking styles, they may be caught heading in the wrong direction. Kerbel warns against "throwing the baby out with the bathwater" and suggests using complementary, non-linear approaches that can work alongside the more linear and mechanical approaches. Some organizations are pushing to adopt the former and this fuels resistance – cultural antibodies resist the trend.

These are the situations where he worries about critical thinking. The WMD Commission identified the need for both more critical thinking and more imagination. The intelligence community responded well to the first task but has done little to address the second. One of the problems is that it is hard to train people to be creative and we tend not to recruit for natural creativity. It is not something that can be covered in a class or two. So we need to find some "fixes" to make the analytic process more non-linear and more dynamic. These should include encouraging managers to pay more attention to generating multiple hypotheses, establishing analytic teams, and supporting more synthesis.

There is a need for smaller, flatter, interdisciplinary teams where they can go beyond sharing information and actually create together. Team analysis has proven very difficult to establish in the bureaucracy. In one organization, an initiative to create a group that would generate alternative hypotheses and produce very creative products foundered because it focused on leaders when it should have been directed at analysts. Analysts are always generating hypotheses but they tend to give weight to the one they prefer and to not give enough weight to the alternative hypotheses.

He suggested that there is a need for a group to address competing hypotheses and to get analysts to use their work. Analysts talk about brainstorming when what they are actually doing is "white boarding" which does not involve any creativity. Teams need to be set up "to get it right," even though the track record of teams has not been encouraging.

7 Comparative Experiences with Analyst-Scientist Cooperation

7.1 Science in Analysis and Analysis in Science: A Practitioner and Private Sector Perspective

Jan Herring was a former US National Intelligence Officer for Science and Technology, and he subsequently worked in the private sector for over 20 years, He was involved in technical intelligence, which he pointed out was not of great utility on its own, unless it was melded with military, diplomatic and sometimes business intelligence. He was asked to pursue the creation of a science and technology (S&T) intelligence office to produce S&T intelligence for use at various levels throughout the national intelligence community.

His team hired S&T professionals such as engineers and scientists, many with "real world" experience in a wide variety of specialized fields such as chemical warfare, air defence, nuclear weapons, airborne weapons, etc. Intelligence specialists then trained them as S&T analysts at a 6-week program that stressed research and writing, the CIA's three elements (subject matter expertise/thought/judgment), all source collection and analysis.

However, the S&T intelligence discipline was somewhat different. It had three dimensions: developing intelligence product (assessing capability, weapons and threats), working on collection tools, and applying science and technology to intelligence processes (such as code-breaking, data storage and retrieval, etc).

S&T intelligence was based on the Dewey Scientific Methodology. It was focused on "real world" and observable "factors" with the result that it was future oriented and collection was closely linked to analysis, with analysis guiding collection. This placed a natural emphasis on all forms of collection: information searching in every conceivable source including repositories and databases of all sorts; technical sources including multi-spectral imaging, signals intelligence, etc; and human intelligence, which is the ultimate source for insight and intent. This in turn called for collaboration and for a "team" framework.

These same principles are true for the business intelligence community where S&T input to R&D planning and decisions is important as it is for sales and marketing (competitive positioning), and for mergers and acquisitions and new business development.

He then outlined some lessons learned about S&T intelligence.

- Since S&T exists in the real world,
    - S&T intelligence is part of that "world"

    - scientists and engineers can provide the best perspective
    - but they must be properly trained for intelligence work

- Provide intelligence education and training:
    - using Dewey Scientific Methodology
    - through proactive collection and analysis
    - by stressing all source collection
    - by focusing on future capabilities and their implications
    - by recognizing that a technological forecast is the best look at the future

- Provide a career development path:
    - initial learning should be under experienced managers.
    - there should be assignments to various user organizations such as military/policy/diplomatic and business.
    - there should be assignments abroad and to non-governmental organizations.

- If S&T is a major element in an issue, or if it could be a determinant in its outcome, be sure to include an S&T intelligence officer in the analytical team.

7.2 U.S. Perspectives: Critical Thinking and Intelligence Analysis

Steven Rieber set out to persuade participants of three things:

(1) Professional intelligence analysts could be much better in thinking through complex issues.
(2) We need lots of scientific research to find ways to help people think better.
(3) Conducting research is an excellent way for intelligence and science to cooperate.

Using a real example of a flawed choice of a dependent variable, he drew three lessons:

(1) Critical thinking is essential – a fundamental mistake in the structure of an analysis can undermine an entire analytic line of thought.
(2) Critical thinking is much more difficult than it appears – even for highly experienced professionals: intelligent, well read and reflective analysts were undermined by their flawed argumentation.
(3) Learning the concepts of critical thinking does not ensure that one thinks well. Selecting on the basis of the dependent variable was understood by the analysts but they fell into the trap anyway – and so did a lot of others.

This is not an isolated case. The WMD Commission reported numerous examples of mistakes in reasoning. It said, “perhaps most troubling, we found an intelligence

community in which analysts have a difficult time stating their assumptions up front, explicitly explaining their logic, and in the end, identifying unambiguously for policymakers what they do not know."

This is a big problem. The obvious solution, training analysts in critical thinking, has some shortcomings. The research using quite good evidence shows that most critical thinking courses are ineffective, though some seem to work well. But there are gaps in this research: the studies were done on college students, not intelligence analysts or other professionals, thus raising questions about how well the extant findings and conclusions drawn from them might generalize to the intelligence domain. Also, there is almost no research on how long the gains in critical thinking persist or how well the skills transfer from the classroom to the workplace. In addition, we do not know how well even the most promising approaches will work when taught by instructors who are less committed to the approach than the people who developed it. Finally, nearly all the research on critical thinking and human judgment is done at the individual level. We know much less about how to help teams reason better.

All this means that we need to take improving thinking and judgment seriously as a research area. It is hard to imagine doing that but other areas like medicine have shown that radical changes based on scientific evidence can happen. Why not in intelligence analysis then?

He left us with three key points:

(1) Since intelligence analysis primarily involves thinking through complex issues, we need to develop better ways to help people think more clearly.
(2) Most of the research on improving thinking for the intelligence community has yet to be done.
(3) Conducting this research together would be a great way for the intelligence and scientific communities to cooperate.

7.3 Australian Perspectives: Simulating the Analytic Environment and Developing Analyst Skills

Colin Wastell and Piers Duncan discussed the SINTELLA project, which stands for simulation of intelligence analysis. Once complete, the goal is to deliver the software tool to analysts for training. More broadly, the research project seeks to identify heuristics and biases that are present when analysts are presented with a tasking.

Drawing on earlier psychological accounts, they noted that there is a dual-process model of thinking: the experiential system and rational system. The experiential system is automatic, rapid and difficult to change. The rational system is intentional, effortful processing which is easier to change and is heavily language based.

They then outlined Stage 1 of SINTELLA which included computer software with an 8 × 8 "information block" or table offering 64 information cells. The program requires students to build a travel advisory for fellow students by selecting information they deem relevant from the table. The software can determine which cells were opened, the duration they were open, the words selected, and what was copied into the workspace. Their initial simulation research found that there is a variation in risk assessment and the length of the reports vary.

They concluded by discussing future developments in the project. They are developing a dataset for ACH via a crime scene scenario ("murder who done it?"). This will be designed to eliminate suspects but not to be absolutely certain as to who is the murderer.

7.4 Canadian Perspectives: A Calibration Study of an Intelligence Assessment Division

Alan Barnes and David Mandel discussed an analyst-scientist project that they have been working on together studying analytical judgments in an assessment organization. Alan Barnes began by discussing problems associated with analytical judgments. He noted the problem of intelligence organization being too casual in their approaches to judgments and communication. This called for greater transparency on how judgments are derived, how we debate and discuss them with peers, and how we communicate them to the client.

Initially Barnes took an informal approach in addressing both aspects. He thought one way to make judgments more transparent would be to externalize the thinking process perhaps using ACH where appropriate, or lists, belief probabilities expressed as numbers out of ten, and/or probability charts.

To improve communication of analytical judgments, Barnes and his colleagues searched for precise terms, avoided the old vague terms, and covered a fully a range of probabilities ending up with a chart of probability terms. Over a couple of years, a file was kept of raw material to allow for a review of judgments. To check for accuracy of judgments, they brought in an outside analyst to carry out a review, which involved tracking whether the predicted events occurred or didn't over the forecasted period.

David Mandel followed up by outlining his current research examining the quality of predictive judgments of a strategic intelligence division by utilizing the data that Barnes and the outside analyst had collected. The judgment data was taken from about an 18 month assessment period and covered 649 predictive judgments abstracted from 51 Intelligence Memoranda produced by the division. Of the judgments, 89% or 580 could be coded in terms of outcome (the remainder were ambiguous). This was facilitated by the practice in the division of assigning a numeric probability estimate on an uncertainty scale (0/10 to 10/10).

Mandel looked at two measures of judgment quality: calibration and discrimination. An analyst is well calibrated if his or her probability judgments of an event occurrence match actual relative frequencies of event occurrence (over the relevant time frame). Discrimination can be thought of as the extent to which the analyst utilizes the full range of the uncertainty scale, and can be interpreted as measure of the proportion of explained variance in the outcome. His findings, to date, indicate that the quality of analytic judgments in the group was "good to excellent," with about 90% of the judged events correctly classified by analysts in the division.

He noted, however, that the causal basis for the high level of performance observed cannot yet be determined, although some factors, such as judgment difficulty, issue importance, and analyst experience could be ruled out since each had a small or negligible effect on calibration. Other plausible determinants that have yet to be investigated include the detailed review process in the organization with multi-expert input, the availability of internal guidelines to promote analytic integrity especially in the assessment and communication of uncertainty, and environmental factors, such as ample time and resources.

He concluded that the research illustrates the potential for the intelligence and scientific communities to work together in order to validate the effectiveness of analytic performance. He also noted that validation field research studies, such as this, are themselves marks of analytic integrity because, in order to improve capabilities and performance, one needs situational awareness of an organization's current standing. Compared to the measured results, intuitions of "how we are doing" and post-mortem analyses of intelligence failures or near misses are poor substitutes. Thus, one recommendation was that intelligence organizations consider the value of "keeping track" of their performance in a systematic manner that allows for a proactive outcome-based accountability system to be implemented. Currently, most efforts are either process-based or reactive.

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8 Applications and Implications for Intelligence Analysis

As on Day 1, during the latter part of Day 2, participants formed into small groups that were asked to discuss what they had learned at the Roundtable and what should be done about it.

In their reports the following issues were raised:

- Is intelligence analysis a guild or a profession? If the former, it is about tradecraft; and, if it is a profession, it should be doing research to build the field.
- There was discussion of synthetic versus analytic versus integrated method. Analysis involves creativity but it involves breaking things into pieces. But there eventually is a need to cobble the bits together.
- There was discussion of generational data and it was suggested that there should be work on what we do right and wrong in the development of experts.
- One suggestion was that the younger, greener analysts should be mixed with more experienced experts.
- There is a need to recognize and reward analysts, such as by getting each service to nominate their best and give them a chance to talk about their views before their peers.
- Perhaps COI POI should work on identifying the criteria for the ideal analyst.
- The greatest improvement in the intelligence domain is coming from outside – perhaps we should be imagining podcasts instead of papers.
- The issue of partnerships was also raised, and three distinct applied groups were identified: the analysts, the managers, and professional developers.
- There was consensus on the importance of getting scientists to talk to analysts and vice versa. Something better than talking every two years is required. There need to be studies to address the challenges identified in the Roundtable. Perhaps we should consider launching a journal for the scientific side of analysis.
- The importance of training was reiterated many times and it was recommended that in training there should be room for a scientific dimension and contribution to that training.
- To advance in this field of collaboration, people underlined the importance of high level buy-in. Intelligence organizations are under huge time pressures, they mainly work at an intense tempo, and they have a low tendency to look inward. So the cycle has to be broken to validate research investments.
- There was widespread enthusiasm by analysts for launching calibration studies such as had been described by Alan Barnes and David Mandel at the Roundtable.
- Richard Hackman's ideas, it was noted, depended somewhat on the issue of scale. Since some organizations are larger than others, perhaps there is a need to

distinguish between “groups” and “teams.” However, it was pointed out that the scale issue could perhaps be got around by creating virtual teams.

- It was observed that participants had been more consensual on the second day than on the first day, in that they recognized that it is both possible and necessary to do worthwhile applied scientific research on analysis, and there is an interest in applying it in the workplace.
- Insights from the research would be interchangeable among COI POI member countries.
- There was a lot of discussion about training, including the potential role of behavioural science in empirically testing the effectiveness of existing and potential future approaches.
- Behavioural science research has found that simple models do very well but today we saw tension over complexity as a fact of analytical life.
- Other tensions addressed included issues of precision, quantification, and the “inside view” (which tends to rely on detail-rich scenarios and imagination about specific cases) versus the “outside view” (which relies on the use of detail-sparse statistical information aggregated over many cases).
- There was debate over the merits of aiming for accuracy in a context of “point precision”. Perhaps giving decision makers insight is more important than precision in predictive estimates. On the other hand, vague estimates can more easily be misconstrued and manipulated, thus there are good reasons for improving at least the precision of our language of uncertainty.

9 Conclusions and Next Steps

The Coordinator reviewed the objectives of the meeting and expressed satisfaction with the positive results obtained in each case. Networks of trust had been developed with new cross disciplinary and trans-boundary relationships cemented. We all learned practical lessons that we can share in our offices next week. And we definitely created new insights and knowledge.

As for next steps, he announced that the next meeting of the COI POI was scheduled for May 7-8, 2009 in Bucharest.

The co-hosts drew the Ottawa Roundtable to a conclusion by thanking the organizers and participants for making it an excellent meeting. The Roundtable had reached consensus on the practical value of the behavioral and cognitive sciences to intelligence analysis. There is a revolution taking place in which, as one participant put it, “everything that is simple is wrong, and everything that is complex is useless”. Analysis needs research and applied scientists need analyst interlocutors to help analysis and assessment to adapt, change and improve.

There was also consensus that it is important for behavioural scientists to translate the ideas of the last two days, which only skimmed the surface of what’s there, and find a way to communicate it all to analysts in order to pursue the goal of developing a collaborative agenda for the future.

The meeting ended at 3 p.m.

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List of symbols/abbreviations/acronyms/initialisms

ACH	Analysis of Competing Hypotheses
CEO	Chief Executive Officer
CIA	Central Intelligence Agency
COI POI	Community of Interest on the Practice and Organization of Intelligence
DND	Department of National Defence
DRDC	Defence Research & Development Canada
GFF	Global Futures Forum
IAS	International Assessment Staff
INR	Bureau of Intelligence Research
ODNI	Office of the Director of National Intelligence
R&D	Research and development
S&T	Science and technology
SINTELLA	Simulation of Intelligence Analysis
UK	United Kingdom
US	United States
WMD	Weapons of mass destruction

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(U) This document summarizes two days of discussion between a number of cognitive and behavioural scientists and professional intelligence analysts from 12 countries and a multilateral organization, which was co−hosted in Ottawa by DRDC, Canada's Privy Council Office, and the US Department of State, February 23−24, 2009. This experimental roundtable explored the question of whether and how behavioural and cognitive sciences can contribute to improved intelligence analysis. It concluded that there are many relevant crossovers between these fields, and the time and cost of further collaboration and "bridging" between the scientist−intelligence practitioner perspectives would be fully justified in terms of strengthened intelligence performance and worthwhile scientific discovery.

(U) Le présent document résume deux jours de discussion entre des spécialistes des sciences cognitives/comportementales et des professionnels de l'analyse du renseignement de 12 pays et d'une organisation multinationale qui ont participé, à Ottawa, à une table ronde organisée conjointement par RDDC, le Bureau du Conseil privé du Canada, et le département d'État des États Unis, les 23 et 24 février 2009. Les participants à cette table ronde expérimentale ont examiné si les sciences cognitives/comportementales peuvent contribuer à l'analyse du renseignement, et de quelle façon. Ils ont conclu qu'il y a de nombreuses interconnections entre ces domaines, et que le temps et les dépenses consacrées à une collaboration plus poussée entre les scientifiques et les professionnels du renseignement seraient pleinement justifiées, car ils pourraient améliorer le rendement des services de renseignement et mener à de précieuses découvertes scientifiques.

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(U) intelligence analysis; cognitive science; behavioural science; summary record; Ottawa Roundtable; Global Futures Forum (GFF)

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